7.2.2 Classwork

Name_______________ Date________

How can I rewrite it?
Investigating the Properties of Logs

today's big goal You learn different properties of logs and how to rewrite equations with different bases.

7-104 **Have your REPORTER/RECORDER read:** Since logs and exponentials are inverses, the properties of exponents (which you already know) translate to logs. The problems below will help you discover these new log properties.

a. Complete the two exponent rules below. In part (b), you will find the equivalent properties of logs.

$$x^a x^b = \_\_\_\_\_\_\_\_\_\_ \quad \text{and} \quad \frac{x^b}{x^a} = \_\_\_\_\_\_\_\_\_\_$$

b. To help you find the equivalent log properties, use your calculator to solve for *x* in each problem below. Note that *x* is a whole number in parts (*i*) through (*v*). Look for patterns that would make your job easier and allow you to **generalize** in part (*vi*).

i. log(5) + log(6) = log(_____)

ii. log(5) + log(2) = log(_____)

iii. log(5) + log(5) = log(_____)

iv. log(10) + log(100) = log(_____)

v. log(9) + log(11) = log(_____)

vi. log(a) + log(b) = log(_____)

c. What if the log expressions are being subtracted instead of added? Solve for *x* in each problem below. Note that

x will not always be a whole number.

i. log(20) – log(5) = log(_____)

ii. log(30) – log(3) = log(_____)

iii. log(5) – log(2) = log(_____)

iv. log(17) – log(9) = log(_____)

v. log(375) – log(17) = log(_____)

vi. log(b) – log(a) = log(_____)

7-105 Learning Log "Log Properties"

The two properties you found in problem 7-104 work for logs in *any* base, not just base 10. (You will officially prove this later.) You now know three different log properties and you have developed a process for solving log problems that are not in base 10.

Write and explain each of the log properties in your flipbook. Be sure to include examples and add an example of a problem where you need to change to base 10. **Title this entry "Log Properties" and label it with today's date.**

7-106

Log Property Puzzles

Use the log properties to fill in the missing parts. Be sure to remember that in every row, each expression is equivalent to every other expression.

		Product Property				Quotient Property		
$\log_3 60$	=	$\log_3 6 +$ _____	=	$\log_3 3 +$ _____	=	$\log_3 120 -$ _____	=	$\log_3 240 -$ _____
$\log_7 36$	=		=		=		=	
	=	$\log_6 9 + \log_6 2$	=		=		=	
	=		=		=	$\log_{25} 75 - \log_{25} 1.5$	=	
	=		=		=	$\log 160 - \log 4$	=	

Cut out and paste into flipbook:

MATH NOTES

METHODS AND MEANINGS

Logarithm Properties

The following definitions and properties hold true for all positive $m \neq 1$.

Definition of logs:	$\log_m(a) = n$ means $m^n = a$
Product Property:	$\log_m(a \cdot b) = \log_m(a) + \log_m(b)$
Quotient Property:	$\log_m(\frac{a}{b}) = \log_m(a) - \log_m(b)$
Power Property:	$\log_m(a^n) = n \cdot \log_m(a)$
Inverse relationship:	$\log_m(m)^n = n$ and $m^{\log_m(n)} = n$

7.2.3 Classwork

Name________________ Date________

How can I find an exponential function?
Writing Equations of Exponential Functions

today's big goal You'll develop strategies for finding the equation of an exponential function given two points and an asymptote.

7-123 Due Date!

Brad's mother has just learned that she is pregnant! Brad is very excited that he will soon become a big brother. However, he wants to know when his new sibling will arrive and decides to do some research. On the Internet, he finds the following article:

Hormone Levels for Pregnant Women

When a woman becomes pregnant, the hormone HCG (human chorionic gonadotropin) is produced to enable the baby to develop.

During the first few weeks of pregnancy, the level of HCG hormone grows exponentially, starting with the day the embryo is implanted in the womb. However, the rate of growth varies with each pregnancy. Therefore, doctors cannot use just a single test to determine how long a woman has been pregnant. They must test the levels over time. Commonly, the HCG levels are measured two days apart to look for this rate of growth.

Brad's mother says she was tested for HCG during her last two doctor visits. On March 21, her HCG level was 200 mIU/ml. Two days later, her HCG level was 392 mIU/ml.

a. Assuming that the model for HCG levels is of the form $y=ab^x$, find an equation that models the growth of HCG for Brad's mother's pregnancy.

b. Assuming that Brad's mother's level of HCG on the day of implantation was 5 mIU/ml, on what day did the baby most likely become implanted? How many days after implantation was his mother's first doctor visit?

c. Brad learned that a baby is born approximately 37 weeks after implantation. When can Brad expect his new sibling to be born?

7-124 Solving Strategies

In problem 7-123, you and your team developed a **strategy** to find the equation of an exponential equation of the form $y=ab^x$ when given two points on the curve.

a. What different **strategies** were generated by the other teams in your class? If no one shares your solving method with the class, be sure to share yours. Take notes on the different **strategies** that are presented.

b. Did any team use a system of exponential equations to solve for a and b? If not, examine this **strategy** as you answer the questions below.

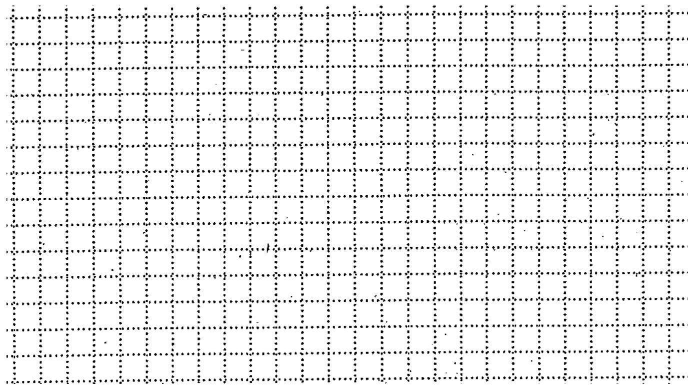
i. The doctor visits provide two data points that can help you find an exponential model: (0,200) and (2,392). Use each of these points to substitute for x and y into $y=ab^x$. You should end up with two equations in terms of a and b.

ii. Consider the **strategies** you already have for solving systems of equations. Are any of those **strategies** useful for this problem? Discuss a way to solve your system from part (*i*) for a and b with your team. Be ready to share your method with the class.

7-125 The context in problem 7-123 required you to assume that the exponential model had an asymptote at *y*=0 to find the equation of the model. But what if the asymptote is not at the *x*-axis? Consider this situation below.

a. Assume the graph of an exponential function passes through the points (3, 12.5) and (4, 11.25). Is the exponential function increasing or decreasing? **Justify** your answer.

b. If the horizontal asymptote for this function is the line *y*=10, make a sketch of its graph showing the horizontal asymptote.



c. If this function has the equation $y = ab^x + k$, what would be the value of *k*? _______ Use what you know about this function to find its equation.

EQUATION OF THIS FUNCTION: _______________________

Verify that as x increases, the values of *y* get closer to y=10 **(using a table or the trace feature on your calculator).**

d. Find the y-intercept of the function. What is the connection between the y-intercept and the asymptote?

7-126

Janice would like to have $40,000 to help pay for college in 8 years. Currently, she has $1000. What interest rate, when compounded yearly, would help her reach her goal?

a. What type of function would best model this situation? Explain how you know and write the general form of this function.

b. If *y* represents the amount of money and *x* represents the number of years after today, find an equation that models Janice's financial situation. What interest rate does she need to earn?

c. Janice's friend Sarah starts with $7800 and wants to have $18,400 twenty years from now. What interest rate does she need (compounded yearly)?

d. Is Janice's goal or Sarah's goal more realistic? **Justify** your response.